

10/018,479

10019479 .051002

WO 00/79858

PCT/GB00/02403

PS  
3/15/05 This appln is a 371 of PCT/GB00/02403 06/21/00  
which is a CIP of 09/524,764 03/13/00 Pat 6,711,797  
which is a CIP of 09/537,845 06/21/99 ABN.

TOOLING FIXTURE

The present invention relates to a tooling fixture for and a method of supporting a workpiece. In particular, the present invention relates to a hydraulic tooling fixture for supporting a flexible substrate such as a printed circuit board in a screen printing machine or a placement machine.

The fabrication of large volumes of electronic circuits is in practice accomplished using automated equipment. Typically, a viscous solder paste is first applied to a printed circuit board using a stencil printing machine, with the solder paste being applied to selected areas of a printed circuit board through a stencil, and electronic components are then placed on the applied solder paste using a placement machine, often referred to as a pick-and-place machine. The printed circuit board and components are then heated in a re-flow oven to a temperature sufficient to melt the solder paste, causing the molten solder to flow over the leads of the components and adjacent areas of the printed circuit board, and thereby form solder joints to complete the electronic circuit.

Such screen printing machines and placement machines normally include a tooling fixture for supporting the lower surface of the printed circuit board during processing. In screen printing machines, the printed circuit board is raised by the tooling fixture until the upper surface of the printed circuit board contacts the stencil. In this raised position, solder paste is applied under pressure to the upper surface of the stencil. The pressure applied by the printing head forces solder paste through the apertures in the stencil and onto the upper surface of the printed circuit board, with the tooling fixture preventing flexure of the printed circuit board away from the stencil during printing. In placement machines, a pick-and-place head sequentially presses electronic components onto predetermined locations on the printed circuit board, with the tooling fixture preventing the printed circuit board from flexing as pressure is applied thereto by the pick-and-place head.

Where components are provided on only one surface of the board, the tooling fixtures merely have to support a flat surface, and only slight modifications need to be made to the